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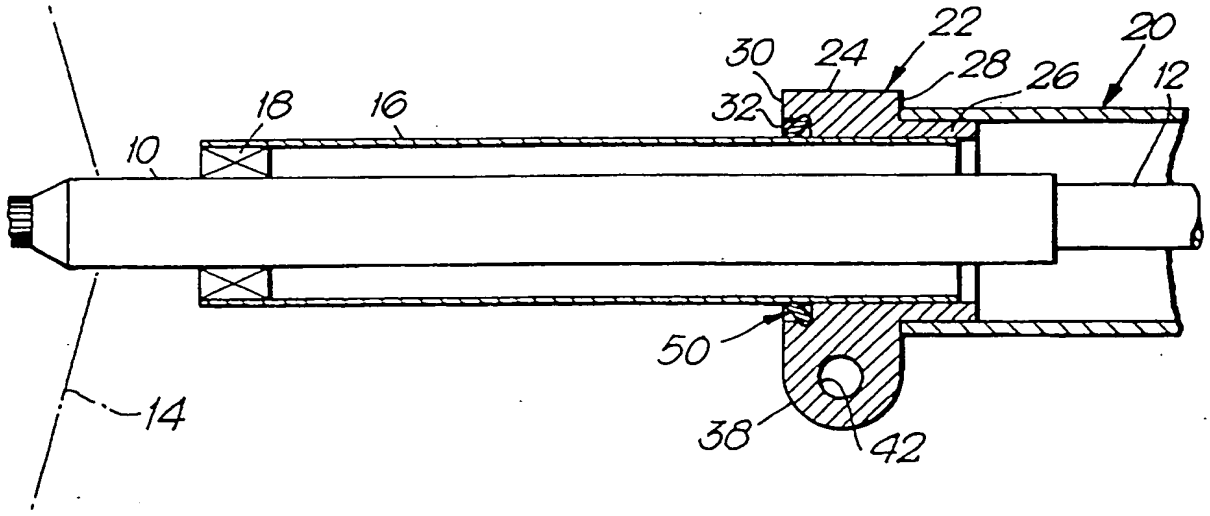
(54) Adjustable steering column assembly.

(57) An adjustable steering column assembly for a vehicle comprises a telescopically adjustable steering column (10, 12) which includes a first telescopic element (10) connectable to a vehicle steering wheel (14) and a second telescopic element (12) connectable to a vehicle steering mechanism. A tubular adjustment element (16) is coupled to the first telescopic element (10), while a tubular support element (20) is disposed around the second telescopic element (12). A clamping member (22) for securing the tubular adjustment and support elements (16, 20) together comprises a resiliently deformable clamping element (50) which, on closure of the clamping member (22), is compressed onto the tubular support element so as to extend in use towards the vehicle steering wheel (14). Either the tubular adjustment element (16) of the tubular support element (20) may include an energy absorber.

Fig. 2.



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The print reflects an assignment of the application under the provisions of Section 30 of the Patents Act 1977.

Fig. 1.

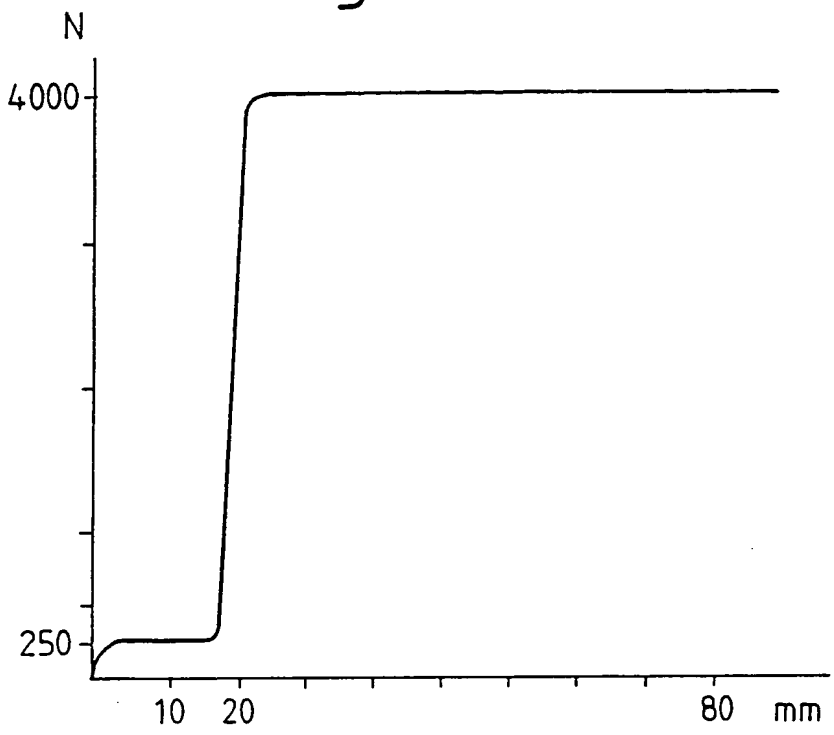


Fig. 3.

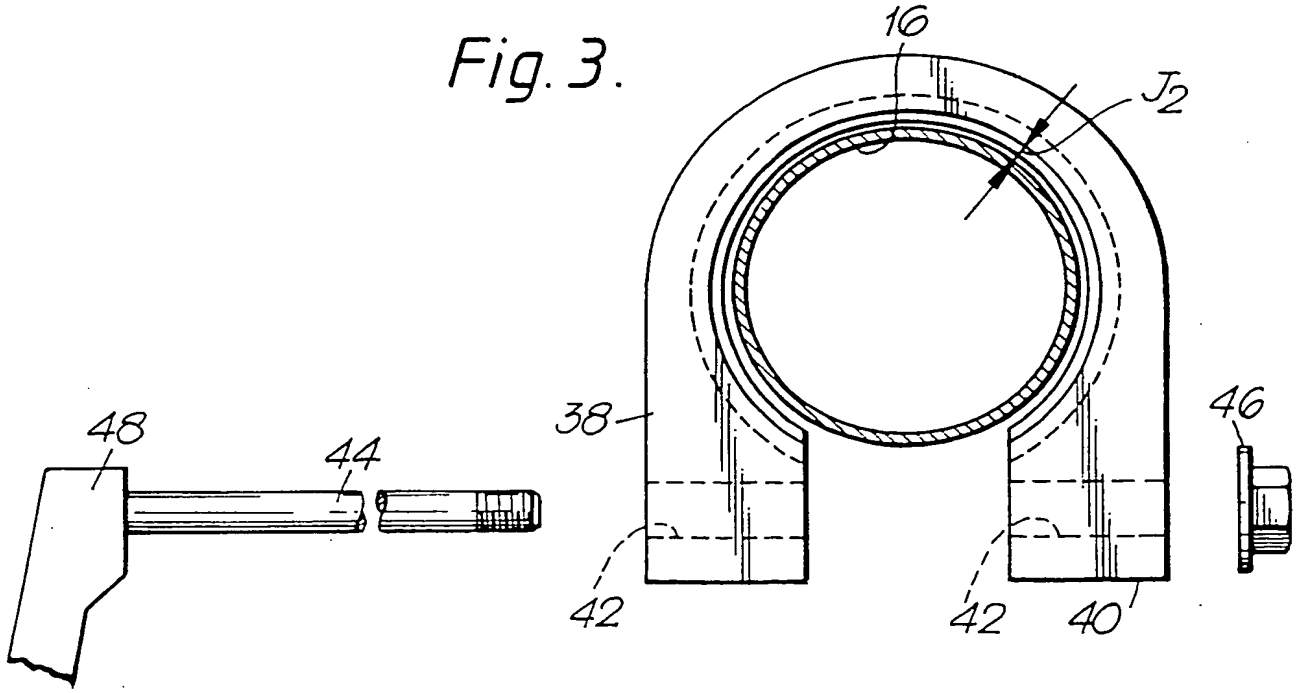


Fig. 2.

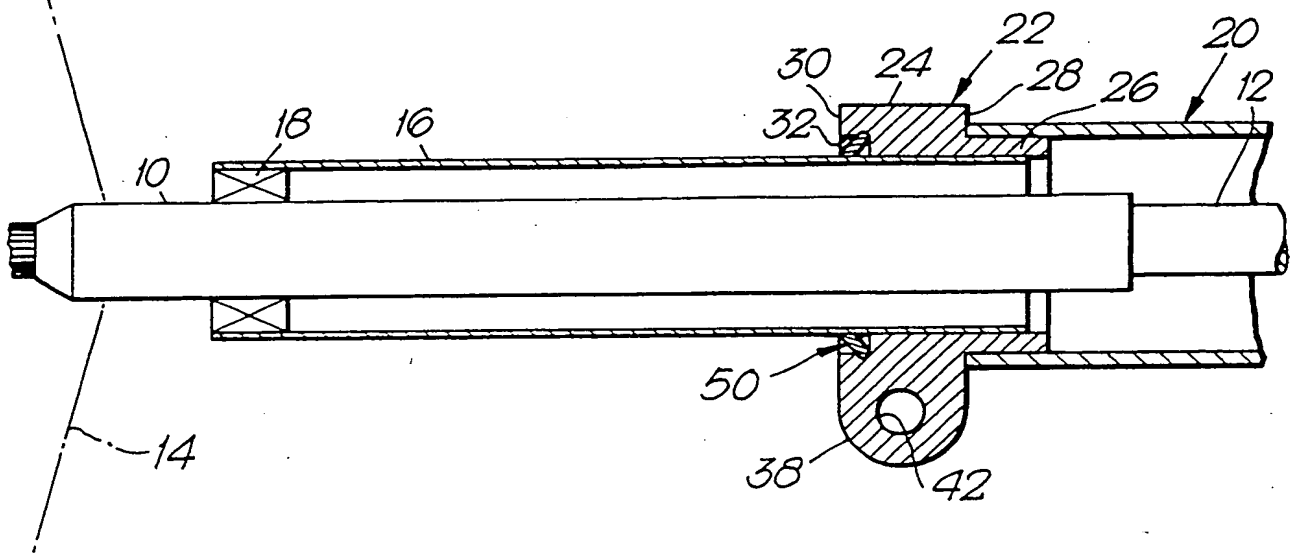


Fig. 7.

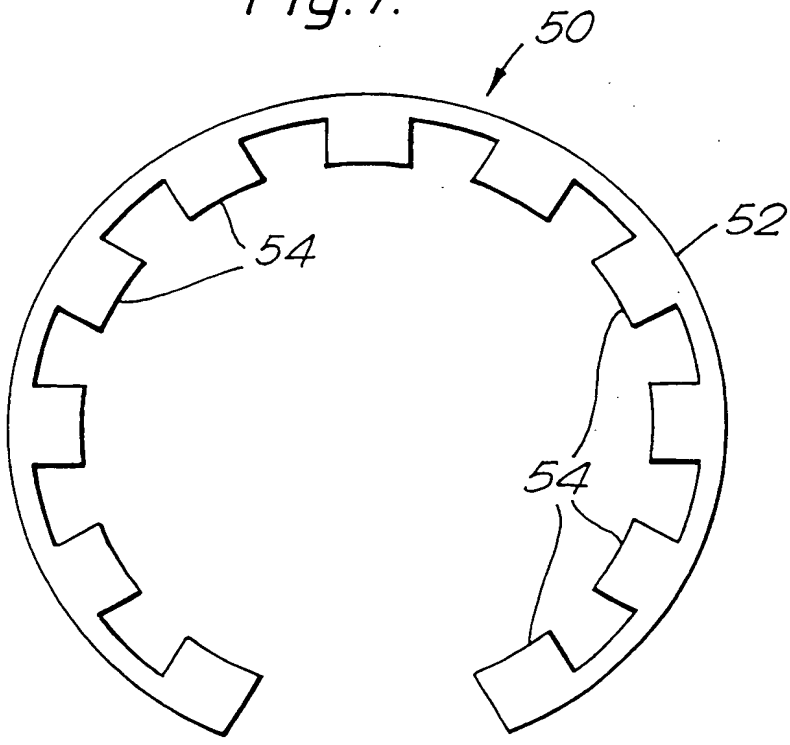


Fig. 4.

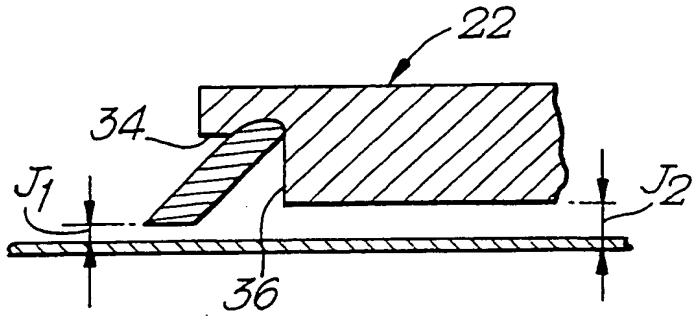


Fig. 5.

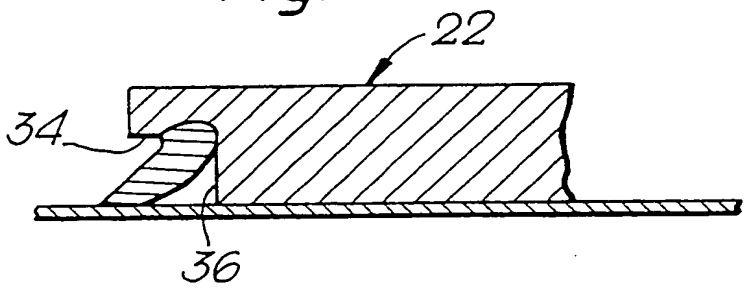
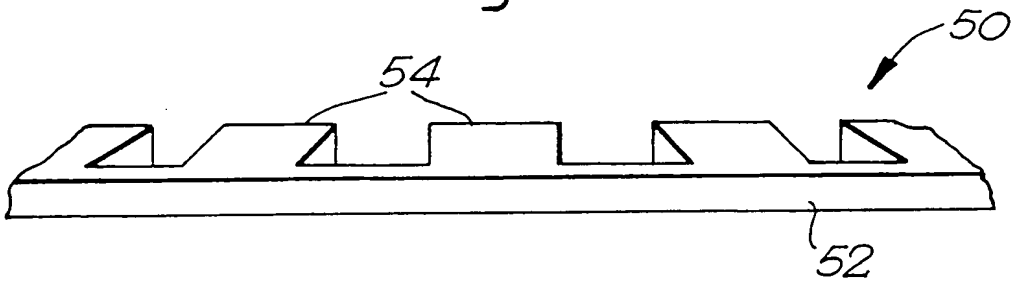


Fig. 6.



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ADJUSTABLE STEERING COLUMN ASSEMBLY

The present invention relates to an adjustable steering column assembly.

In some known steering column assemblies, the steering column is adjustable telescopically by the driver for comfort. With such assemblies, the steering wheel is connected to a telescopically movable steering column element, locatable in position by a clamping block secured to a vehicle structure, for example part of the fire wall. The clamping block is releasable by a manually operated lever to unlock the telescopic element therefrom to enable the steering wheel to be moved towards or away from the driver. Closure of the clamping block then locks the telescopic element in the chosen position.

Although such a system generally operates acceptably, the resistive force against telescopic movement of the telescopic element produced by the manually operated clamping block, in practice, is no more than around 250 Newtons. This can be a problem with collapsible steering columns designed to collapse during a vehicle collision to absorb the driver's kinetic energy as the driver is projected towards the steering wheel. Such steering columns are generally designed to begin collapsing at a force of around 4000 Newtons.

Thus, with the above prior art adjustable assembly, during a collision there would be two stages of collapse, the first stage caused by collapse at the clamping block up to the point at which the steering wheel abuts the clamping block, the second stage caused by the collapse of the energy absorber of the steering column assembly. This two-stage collapse is shown in graphical form in Figure 1 of the accompanying drawings, in which it can be seen that there is an initial collapse of about 20 mm at a first retarding force of around 250 Newtons caused by collapse of the clamping block. Once the

clamping block reaches the end of its possible travel, the energy absorber begins to collapse, producing the desired retarding force, usually around 4000 Newtons.

The present invention seeks to provide an improved adjustable steering column assembly.

According to an aspect of the present invention, there is provided an adjustable steering column assembly for a vehicle comprising a telescopically adjustable steering column which includes a first telescopic element connectable to a vehicle steering wheel and a second telescopic element connectable to a vehicle steering mechanism; a tubular adjustment element coupled to the first telescopic element in a non-axially slidable manner, a tubular support element, and a clamping member fixed to one of the tubular adjustment and support elements and selectively closable onto the other of the tubular adjustment and support elements to secure the tubular adjustment and support elements together and selectively openable to enable the tubular adjustment element to slide relative to the tubular support element; the clamping member comprising a resiliently deformable clamping element which, on closure of the clamping member, is compressed onto one of the tubular adjustment and support elements so as to extend in use towards the vehicle steering wheel and to provide a retaining force against axial movement of the tubular adjustment element relative to the tubular support element. The clamping element can readily be designed to have a failure strength greater than the collapse strength of a typical energy absorber of a collapsible steering mechanism, thereby enabling normal collapse of the energy absorber, without any adverse effect being produced by failure of the clamping element.

Preferably, the clamping member includes a recess in an internal surface thereof, the deformable clamping

element being disposed in the recess. The recess can provide an effective way of retaining the deformable clamping element in position.

Advantageously, the deformable clamping element comprises a base member and a deformable portion extending towards a centre point of the base member, the deformable portion in use being compressed onto one of the tubular adjustment and support elements so as to extend towards the vehicle steering wheel. In a preferred embodiment, the deformable portion comprises eleven deformable teeth substantially equally spaced from one another along the base member.

Alternatively, the deformable clamping element may be substantially generally annular.

In the preferred embodiment, the tubular adjustment element is adapted to slide within the tubular support element.

Advantageously, the deformable clamping element in use produces a retaining force greater than substantially 4000 Newtons.

The deformable clamping element is preferably made from spring steel.

In a preferred embodiment, the adjustable steering column assembly includes a mechanism for enabling collapse of the steering column during, for example, a collision.

An embodiment of the present invention is described below, by way of illustration only, with reference to the accompanying drawings, in which:

Figure 1 shows a graph of force against amount of collapse for a prior art adjustable and collapsible steering column;

Figure 2 is a side elevational view in cross-section of an embodiment of adjustable steering column assembly;

Figure 3 is a plan view of a clamping block of the steering column assembly of Figure 2;

Figure 4 is a radial cross-sectional view of part of the clamping block of Figure 3 and of a clamping element in a closed state;

Figure 5 is a radial cross-sectional view of part of the clamping block of Figure 3 and of a clamping element in a open state;

Figure 6 is a rear elevational view in perspective of part of the clamping element of Figures 4 and 5; and

Figure 7 is a plan view of the clamping element of Figures 4, 5 and 6.

Referring to Figure 2, a vehicle steering column assembly of collapsible type includes a first telescopic member 10 coupled in conventional manner to a vehicle steering wheel 14, shown in dotted outline. A second telescopic member 12 is coupled to a conventional steering mechanism (not shown) and is slidable within the first telescopic member 10. A tubular adjustment element 16 envelops the first telescopic member 10 and is supported at its end adjacent the steering wheel 14 by the first telescopic member 10 through an annular bearing 18 of conventional type and which prevents the first telescopic member 10 from sliding axially relative to the tubular adjustment element 16 but which enables the first telescopic member 10 to rotate in the tubular element 16. Suitable bearings are known in the art so are not described in further detail herein. The second telescopic element 12 is located within a tubular support 20.

Either or both the tubular adjustment element 16 and the tubular support 20 may include an energy absorber of the type used in collapsible steering column assemblies, for example of the type disclosed in our co-pending British patent application no. 9311564.0... (RJ/550) filed the same day as this application, British patent application No 9300541.1, GB-A-1,159,058, GB-A-1,200,437 or GB-A-1,369,188.

The tubular support 20 has a larger axial cross-sectional diameter than the tubular adjustment element 16 and is coupled to the adjustment element 16 by a generally annular clamping block 22, best seen in Figures 2 and 3. The clamping block 22 includes a generally U-shaped body portion 24 and an annular flange 26 extending from the body portion 24. The annular flange 26 has an outer surface of smaller diameter than the diameter of the outer surface of the body portion 24 and an inner surface substantially flush with the inner surface of the body portion 24.

The tubular support 20 is secured to the outer surface of the annular flange 26 in such a manner as to allow release of the clamping element 22 for adjustment of the position of the steering wheel, described in further detail below. The tubular support abuts a shoulder 28 formed between the outer surfaces of the annular flange 26 and the body portion 24.

The body portion 24 also includes, at an end remote from the annular flange 26, a portion 30 of reduced thickness, having an outer diameter substantially the same as the outer diameter of the body portion 24 and an inner diameter greater than the inner diameter of the body portion, so as to provide an annular recess 32 in the body portion 24. The annular recess 32 is formed from two substantially perpendicular walls 34,36 best seen in

Figures 4 and 5, one of which, wall 34, is the inner surface of the reduced thickness portion 30. Adjacent the wall 36 of the body portion 24, the wall 34 of the portion 30 has an annular groove of curved form for use in housing a clamping element 50, described in further detail below.

As can be seen clearly in Figures 2 and 3, the body portion 24 includes two clamping ends 38,40 which face one another and which include substantially aligned circular bores 42 therein for the receipt of a clamping bolt 44 and nut 46. The clamping bolt 44 is fixed to a handle 48 operable by the driver. The clamping block 22 is secured to a suitable vehicle supporting structure.

Referring to Figures 6 and 7, the clamping element 50, which is formed from spring steel or other suitable material, includes a base member 52 in the form of an open ring and, in this embodiment, eleven substantially equally spaced teeth 52 disposed substantially in the plane of the base member 52 and extending towards the centre of the clamping element 50. As can be seen in Figures 2, 4 and 5, the base member 52 of the clamping element 50 rests within the annular groove in the inner wall 34 of the portion 30 of the clamping block 22, while the teeth 54 extend through the annular recess 32 and beyond the inner surface of the clamping block 22, in a direction towards the steering wheel 14.

When the bolt 44 is turned by the handle 48 to open the clamping block, as in Figures 3 and 4, the clamping block 22 expands such that the teeth 54 of the clamping element 50 are spaced from the tubular adjustment element 16, which can therefore slide within the clamping block 22 for adjustment of the position of the steering wheel 14. On the other hand, when the bolt 44 is turned to close the clamping block 22, as in Figures 2 and 5, the clamping element 50 is compressed onto the tubular

adjustment element 16 such that the teeth 54 are resiliently deformed and assume a slightly curved shape, as shown in Figure 5. In this closed state, the clamping block 22 is a tight fit on the tubular adjustment element 16.

The teeth 54 of the clamping element 50 fix the tubular adjustment element 16 to the clamping block 22 such that the force required to collapse an energy absorber fitted to the steering mechanism is less than the force required to rupture the connection between the teeth 54 and clamping block 22 and the tubular adjustment element 16.

Thus, during a collision, collapse of the steering column assembly will take place only on collapse of the energy absorber to provide a substantially uniform retarding force of, for example, 4000 Newtons. The connection between the tubular element 16 and the clamping block 22 will remain substantially intact, unless and until the impact force exceeds the failure force, which would occur after collapse of the energy absorber.

The clamping element 50 may have a variety of other forms, for example it may have a different number of teeth or a single element extending along the base member 50. The clamping block 22 may be readily modified by a person skilled in the art to suit a steering assembly in which the tubular adjustment element 16 slides within the support element 20, the teeth 54 being arranged to point towards the steering wheel 14.

Claims:

1. An adjustable steering column assembly for a vehicle comprising a telescopically adjustable steering column which includes a first telescopic element connectable to a vehicle steering wheel and a second telescopic element connectable to a vehicle steering mechanism; a tubular adjustment element coupled to the first telescopic element in a non-axially slidable manner, a tubular support element, and a clamping member fixed to one of the tubular adjustment and support elements and selectively closable onto the other of the tubular adjustment and support elements to secure the tubular adjustment and support elements together and selectively openable to enable the tubular adjustment element to slide relative to the tubular support element; the clamping member comprising a resiliently deformable clamping element which, on closure of the clamping member, is compressed onto one of the tubular adjustment and support elements so as to extend in use towards the vehicle steering wheel and to provide a retaining force against axial movement of the tubular adjustment element relative to the tubular support element.

2. An adjustable steering column assembly according to claim 1, wherein the clamping member includes a recess in an internal surface thereof, the deformable clamping element being disposed in the recess.

3. An adjustable steering column assembly according to claim 1 or 2, wherein the deformable clamping element comprises a base member and a deformable portion extending towards a centre point of the base member, the deformable portion in use being compressed onto one of the tubular adjustment and support elements so as to extend towards the vehicle steering wheel.

4. An adjustable steering column assembly according to claim 3, wherein the deformable portion comprises eleven deformable teeth substantially equally spaced from one another along the base member.

5. An adjustable steering column assembly according to any preceding claim, wherein the deformable clamping element is substantially generally annular.

6. An adjustable steering column assembly according to any preceding claim, wherein the tubular adjustment element is adapted to slide within the tubular support element.

7. An adjustable steering column assembly according to any preceding claim, comprising collapsing means adapted to enable the steering column to collapse during a vehicle collision.

8. An adjustable steering column assembly according to any preceding claim, wherein the deformable clamping element in use produces a retaining force greater than substantially 4000 Newtons.

9. An adjustable steering column assembly according to any preceding claim, wherein the deformable clamping element is made from spring steel.

10. An adjustable steering column assembly substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

F .ents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report) — 10 —

Application number
GB 9311617.6

Relevant Technical fields

(i) UK Cl (Edition L) F2Y (YSQ)

(ii) Int Cl (Edition 5) B62D

Search Examiner
PHIL THORPE

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search
28 JULY 1993

Documents considered relevant following a search in respect of claims 1-10

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2116496 A (GENERAL MOTORS)	-
A	GB 1185826 (ROOTES MOTORS)	-

Category	Identity of document and relevant passages	Relev to clai.. .s)
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Categories of documents

X: Document indicating lack of novelty or of inventive step.

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